Typhoid Fever (*Salmonella typhi)*

(Also known as Enteric Fever, Typhus Abdominalis)

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Note: This chapter focuses on typhoid fever (caused by *Salmonella typhi)*. For information about non-typhoid salmonellosis, refer to the chapter entitled "Salmonellosis (Non-Typhoid)."

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Typhoid fever is a systemic bacterial disease caused primarily by *Salmonella typhi.* A new *Salmonella* nomenclature has been proposed based on DNA correlation. The proposed nomenclature would change *S. typhi* to *S. enterica* serovar Typhi, abbreviated *S.* Typhi.

B. Clinical Description and Laboratory Confirmation

Typhoid fever has a different presentation than common salmonellosis. Initial symptoms typically include sustained fever, anorexia, lethargy, malaise, dull continuous headache, splenomegaly, relative bradycardia and non-productive cough. Vomiting and diarrhea are typically absent, but constipation is frequently reported. During the second week of illness, there is often a protracted fever and mental dullness, which is how the disease got the name "typhoid," which means "stupor-like." After the first week or so, many cases develop a maculopapular rash (rose-colored spots) on the trunk and upper abdomen. Other symptoms can include intestinal bleeding, slight deafness and parotitis. Mild and atypical infections are common, but as many as 10–20% of untreated infections may be fatal (the case-fatality rate is <1% with prompt antibiotic treatment). Relapses are not uncommon. Paratyphoid fever is a similar illness but is usually much milder and is caused by the organism *Salmonella paratyphi*.

Laboratory diagnosis is based on isolation of *S.* Typhi from the blood early in the disease and from stool and urine after the first week of disease. Salmonella can be also cultured from the bone marrow (This is the single most sensitive method of isolating of *S.* Typhi). The serologic test (Widal test) is generally of little diagnostic value.

C. Reservoirs

Humans are the reservoir for *S.* Typhi and *S. paratyphi*. Domestic animals may harbor *S. paratyphi,* but this is rare. Chronic carriers are the most important reservoirs for *S* .Typhi. About 2–5% of cases become chronic carriers, some after mild or inapparent infection. Persons with abnormalities of the genitourinary system, including schistosomiasis have a much higher prevalence of urinary carriage than those with a normal system.

D. Modes of Transmission

S. typhi is transmitted via the fecal-oral route, either directly from person-to-person or by ingestion of food or water contaminated with feces or urine. Shellfish harvested from sewage-contaminated water are potential vehicles, as are fruits and vegetables grown in soil fertilized with human waste in developing countries. Transmission can also occur person-to-person through certain types of sexual contact (*e.g.,* oral-anal contact).

E. Incubation Period

The incubation for typhoid fever ranges from 3 days to 1 month (depending on the infecting dose), with a usual range of 1–2 weeks. For paratyphoid fever, the incubation is usually 1–10 days.

F. Period of Communicability or Infectious Period

The disease is communicable for as long as the infected person excretes *S.* Typhi or *S. paratyphi* in the feces or urine. This usually begins about a week after onset of illness and continues through convalescence and for a variable period thereafter. If a carrier state develops, excretion of *S*. Typhi or *S.paratyphi* could be permanent.

G. Epidemiology

The annual incidence of typhoid fever worldwide is approximately 17 million cases, with an estimated 600,000 deaths. In the United States, less than 500 cases occur each year, and 70% of these are acquired while traveling internationally. Over the past 10 years, travelers to Asia, Africa and Latin America have been especially at risk. Antimicrobial-resistant strains are becoming increasingly prevalent. Outbreaks have occurred in the United States from food that had been brought here from other countries. Despite suggestions to the contrary, outbreaks do not occur as a result of floods or other disasters in countries that do not have endemic typhoid, such as the United States. In New Jersey, approximately 25 cases of typhoid fever are reported annually to New Jersey Department of Health and Senior Services.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. New Jersey Department of Health and Senior Services (NJDHSS) Case Definition

CASE CLASSIFICATION

A. CONFIRMED

A clinically compatible case, **AND**

- Isolation of *Salmonella typhi* from blood, stool, or other clinical specimen.

NOTE: Asymptomatic carriage should be reported as *Salmonella typhi* **not** typhoid fever.

B. PROBABLE:

A clinically compatible case that is epidemiologically linked to a confirmed case in an outbreak.

C. POSSIBLE

Not used.

NOTE: Serologic evidence alone is not sufficient for diagnosis.

NOTE Isolates of Salmonella *typhi* must be submitted within the three (3) working days to the New Jersey Department of Health and Senior Services, Division of Public Health and Environmental Laboratories, Specimen Receiving and Records, P.O. Box 361, John Fitch Plaza, Trenton, NJ 08625-0361.

B. Laboratory Testing Services Available

The PHEL requests that all laboratories submit all *Salmonella typhi* isolates for typing to aid in public health surveillance (N.J.A.C. 8:57-1.6 (f)). For more information on submitting specimens, contact the PHEL at 609.292.7368.

After authorization from the Division of Epidemiology, Occupational and Environmental Services, PHEL will test implicated food items from a cluster or outbreak.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify whether the case may be a source of infection for other persons (*e.g.,* a diapered child, daycare attendee or foodhandler) and if so, to prevent further transmission.

- To identify sources of public health concern (*e.g.,* a commercially distributed food product) and to stop transmission from such a source.

B. Laboratory and Healthcare Provider Reporting Requirements

The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that laboratories and health care providers report (by telephone, confidential fax, over the Internet using the Communicable Disease Reporting System [CDRS] or in writing) all cases typhoid fever of to the local health officer having jurisdiction over the locality in which the patient lives, or, if unknown, to the health officer in whose jurisdiction the health care provider requesting the laboratory examination is located.

C. Local Health Departments Reporting and Follow-Up Responsibilities

1. **Reporting Requirements**

The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that each local health officer must report the occurrence of any case of typhoid fever, as defined by the reporting criteria in Section 2A. above. Current requirements are that cases be reported to the NJDHSS Infectious and Zoonotic Diseases Program (IZDP) using the CDS-1 reporting form, and an official CDC Typhoid Fever Surveillance Report form. The report can also be filed electronically over the Internet using the confidential and secure (CDRS).

2. **Case Investigation**

It is requested that the health officer complete a CDS-1 reporting form and an official CDC Typhoid Fever Surveillance Report form by interviewing the patient and others who may be able to provide pertinent information. Much of the information on the forms can be obtained from the patient's healthcare provider or the medical record. When contacting the hospital, check with the infection control professional if the laboratory submitted the isolate to the PHEL. **If CDRS is used to report, enter the collected information into the "Comments" section.**

a. Use the following guidelines for assistance in completing the report:
   1) Accurately record the demographic information, date of symptom onset, symptoms, and medical information including history of vaccination against typhoid fever.
   2) When asking about exposure history (food, travel, activities, etc.), use the incubation period for *S.* Typhi (1–3 weeks). Specifically, focus on the period beginning a minimum of 1 week prior to the patient's symptoms onset date back to no more than 3 weeks before onset.
   3) If possible, record any restaurants at which the patient ate, including food item(s) and date consumed. If you suspect that the patient became infected through food, use the Patient Food History Listing to facilitate recording additional information.
   4) Ask questions about travel history and outdoor activities to help identify where the patient became infected.
   5) Ask questions about water supply; *S.* Typhi may be acquired through water consumption.
   6) Determine whether the patient attends or works at a daycare facility and/or is a foodhandler.
   7) If there have been several attempts to obtain case information (*e.g.,* the patient or healthcare provider does not return your calls or does not respond to a letter, or the patient refuses to divulge information or is too ill to be interviewed), please fill out the form with as much information as possible. Please note on the form the reason why it could not be filled out completely. **If CDRS is used to report, enter the collected information into the "Comments" section**

b. Complete an official CDC Typhoid Fever Surveillance Report form. The Program will forward this form to the CDC. Please pay special attention to questions regarding antibiotic resistance, typhoid vaccination, and travel history. There is extra room under the "Comments" sections at the bottom of the page.

c. After completing the case report form CDS-1 and the CDC Typhoid Fever Surveillance Report form and attaching the lab report(s), it should be mailed (in an envelope marked "Confidential") to the NJDHSS IZDP. The report can also be filed electronically over the Internet using the confidential and secure CDRS.

The mailing address is:

NJDHSS
Division of Epidemiology, Environmental and Occupational Health
Infectious and Zoonotic Diseases Program
P.O. Box 369
Trenton, NJ 08625-0369

e. Institution of disease control measures is an integral part of case investigation. It is the local health officer's responsibility to understand, and, if necessary, to institute the control guidelines listed below in Section 4, "Controlling Further Spread."

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (N.J.A.C. 8:57-1.12)

Patients can be released from supervision from local health department after no fewer than **three (3)** consecutive negative cultures of stool (and urine in patients with schistosomiasis) taken at least 24 hours apart and at least 48 hours after any antimicrobials. If any of these are positive, repeat cultures at intervals of 1 month during the 12 months following onset until at least **three (3)** consecutive negative cultures are obtained. Foodhandlers with *S*. Typhi must not work directly with food. For foodhandlers with *S. paratyphi* or other *Salmonella* species, please refer to Section 4A of the chapter entitled "Salmonella (Non-Typhoidal)."

Minimum Period of Isolation of Patient

Foodhandlers must not work directly with food until they have **three (3)** consecutive, negative stool specimens taken no less than 48 hours apart. If the patient has been treated with an antimicrobial, the first stool specimen shall not be submitted until at least 48 hours after completion of therapy.

Minimum Period of Quarantine of Contacts

All foodhandling employees, symptomatic or asymptomatic, who are contacts of a patient with typhoid fever shall be considered the same as a patient and handled in the same fashion.

Note: A foodhandler is any person directly preparing or handling food. This can include a patient care or child care provider.

B. Protection of Contacts of a Case

Members of households of known carriers are candidates for immunization and should check with their healthcare providers for vaccine options.

C. Managing Special Situations

Daycare

Since typhoid fever may be transmitted person-to-person through fecal-oral transmission, it is important to carefully follow up patients with typhoid fever in a daycare setting. General recommendations include:

- A child care attendee or staff member in whom *S*. Typhi is identified should be excluded until **three (3) consecutive negative stool cultures** are obtained, each taken 48 hours apart (and no sooner than 48 hours after the completion of antibiotic therapy). In addition, stool specimens from all staff and attendees should be tested, and all infected individuals excluded as well.

School
Since typhoid fever may be transmitted person-to-person through fecal-oral transmission, it is important to carefully follow up cases of typhoid fever in a school setting. General recommendations include:

- Students or staff member with *S*. Typhi who are experiencing symptoms, such as diarrhea, fever and abdominal pain should be excluded until symptoms are gone.

- Students or staff with *S*. Typhi who do not handle food, have no symptoms and are not otherwise ill, may remain in school if special precautions are taken. If a patient with *S*. Typhi occurs in a kindergarten, 1st grade or a preschool class (where hygiene may not be optimal), more stringent control measures may be indicated (see Daycare section above).

- Students or staff who handle food and have a *S*. Typhi infection (symptomatic or not) must not prepare or handle food for others until they have **three (3)** negative stool tests taken 48 hours apart (and no sooner than 48 hours after the cessation of antibiotic therapy).

Community Residential Programs
Actions taken in response to a patient with *S*. Typhi living in community residential programs will depend on the type of program and the level of functioning of the residents.

In long-term care facilities, residents with *S*. Typhi should be placed on standard (including enteric) precautions until symptoms subside *and* they test negative with **three (3)** consecutive stool samples. Close contacts in the long-term care facility, including staff and roommates, should also be tested. If positive, they should be placed on enteric precautions until producing **three (3)** negative stool cultures. Staff members with typhoid fever infection who give direct patient care (*e.g.,* feed patients, give mouth or denture care, give medications) are considered foodhandlers and must be excluded until producing **three (3)** negative stool specimens.

In residential facilities for the developmentally disabled, staff and clients with *S*. Typhi must refrain from handling or preparing food for other residents until their symptoms have subsided and **three (3)** stool specimens test negative (taken 48 hours apart and no sooner than 48 hours after the cessation of antibiotic therapy). Other close contacts in the facility should be tested as well, and if positive, subject to the same restrictions stated above.

Reported Incidence Is Higher than Usual/Outbreak Suspected
If one or more cases of *S*. Typhi is/are reported in a city/town among people who have not traveled out of the United States, investigate the patient or patients to determine source of infection and mode of transmission. A common vehicle (such as water, food or association with a daycare center) should be determined and applicable preventive or control measures should be instituted. Control of person-to-person transmission requires special emphasis on personal hygiene and sanitary disposal of feces. Consult with NJDHSS IZDP. The Program staff can help determine a course of action to prevent additional infections and can perform surveillance for patients that may cross several jurisdictions and therefore be difficult to identify at a local level.

D. Preventive Measures

Environmental Measures
Implicated food items must be removed from the environment. A decision about testing implicated food items can be made in consultation with the NJDHSS IZDP and the Food and Drug Safety Program (FDSP). The FDSP can help coordinate pickup and testing of food samples. If a commercial product is suspected, the FDSP will coordinate follow-up with relevant outside agencies (e.g. FDA, USDA). The FDSP can be reached at 609.588.3123.
Note: The role of the FDSP is to provide policy and technical assistance with the environmental investigation such as interpreting the New Jersey Food Code, conducting a hazardous analysis and critical control points (HACCP) risk assessment, initiating enforcement actions and collecting food samples.

The general policy of the PHEL is only to test food samples implicated in suspected outbreaks, not in single cases (except when botulism is suspected). The health officer may suggest that the holders of food implicated in single case incidents locate a private laboratory that will test food or store the food in their freezer for a period of time in case additional reports are received. However, a single, confirmed case with leftover food consumed within the incubation period may be considered for testing only under special circumstances.

Personal Preventive Measures/Education

To avoid exposure, recommend that individuals:

- Wash their hands thoroughly with soap and water before eating or preparing food, after using the toilet and after changing diapers.
- Dispose of feces in a sanitary manner, especially in a daycare setting.
- Scrub their hands thoroughly with plenty of soap/water after assisting in the following: caring for someone with diarrhea, cleaning toilets, or changing soiled diapers, clothing or bed linens.
- Avoid sexual practices that may permit oral contact with feces or urine. Latex barrier protection should be emphasized as a way to prevent the spread of typhoid fever to sexual partners as well as being a way to prevent the exposure to and transmission of other pathogens.

International Travel

Persons travelling to typhoid endemic areas should consider vaccination against typhoid fever. They should check with their healthcare provider or a travel clinic for vaccine options. This needs to be done in advance so that the vaccine has time to take effect. Typhoid vaccination loses effectiveness after several years; people vaccinated in the past should check with their doctor to see if they need a booster. Typhoid vaccination is not 100% effective; therefore, travelers must exercise caution when consuming local foods and beverages (which will also protect travelers from other illnesses including travelers' diarrhea, cholera, dysentery and hepatitis A).

Recommend the following to travelers:

- "Boil it, cook it, peel it, or forget it." Avoid foods and beverages from street vendors.
- Drink only bottled or boiled water, keeping in mind that bottled carbonated water is safer than uncarbonated water.
- Ask for drinks without ice unless the ice is made from bottled or boiled water.
- Avoid popsicles and flavored ices that may have been made with contaminated water.
- Eat foods that have been thoroughly cooked and are still hot and steaming.
- Avoid raw vegetables and fruits that cannot be peeled. Vegetables like lettuce are easily contaminated and are very hard to thoroughly wash.

Note: For more information regarding international travel and the typhoid fever vaccine, contact the Centers for Disease Control and Prevention "Travelers Health" at 877.394.8747.

ADDITIONAL INFORMATION

A *Typhoid Fever Fact Sheet* can be obtained at the NJDHSS website at <http://www.state.nj.us/health>.

The CDC surveillance case definition for typhoid fever is the same as the criteria outlined in Section 2A of this chapter. CDC case definitions are used by state health departments to maintain uniform standards for national reporting. When reporting to the NJDHSS, always refer to the criteria in Section 2A.

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